Requirements Specification

4/30/2022

Project:
C & I Doctoral Tracking Tool

Project Sponsor:
Gretchen McAllister

Faculty Member:
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Team Name:
What's Up Doc

Team Members:
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Accepted as the baseline requirements for the project.

Client: _____   **Project Lead:** _____

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1.0 Introduction

Learning from one's mistakes is a key aspect of development and that is key in the world of education. It involves a simple feedback loop: take an examination, turn said exam in, and receive a grade. Exposure to this feedback starts as early as second or third grade and continues throughout higher education and in certain careers thereafter.

According to data reported in 2021, 16.6 million undergraduate students and 3.1 million graduate students attended universities across the United States. [1] Many of those 16.6 million undergraduate students likely used software called Learning Management Systems (LMS) to help facilitate course delivery and act as grade feedback tools. Learning Management Systems, such as Blackboard Learn or Canvas, are traditionally able to accommodate most undergraduate classes due to the innate pass/fail or A-F grade system that they follow. Assignments and examinations from class to class are quite rigid in that they pertain to lectures or chapters of an assigned reading, thus they may be outlined and planned before a semester even begins. This rigidity is absent in graduate school as graduate students perform activities that are less quantifiable, such as shadowing mentors and researching. Therefore, it is considerably harder to deliver the graduate program using a LMS.

The Coordinator of the Curriculum and Instruction (C&I) doctoral program at Northern Arizona University (NAU), Gretchen McAllister, Ph.D., and Administrative Services Assistant, Michele Benedict, have both experienced the shortcomings of Blackboard Learn firsthand. As a result, neither is able to track the milestones of their graduate students particularly well. In order to attain candidacy in the C&I Ph.D program, graduate students must complete a minimum of 60 graduate-level course units, professional development requirements, comprehensive written and oral exams, a qualifying research paper, approval and assignment of a dissertation committee, and submission of an approved dissertation prospectus. These many milestones must be tracked one way or another.

2.0 Problem Statement

Due to the subjectivity and intensity of the milestones associated with a graduate course, a standard LMS is not able to track progress. However, feedback facilitates learning from one's mistakes and most graduate students recognize its absence from the learning process. In order for the NAU C&I doctoral program to maintain a level of accreditation, and for the sake of the students, an alternative way to track milestones must have been implemented.

At present, Gretchen and Michele are having graduate students funnel all deliverables to a single university computer via email. After the acceptance of a graduate student into the C&I doctoral program, a desktop folder is created on said local university computer titled with the student's name. Students then submit the required documents to Ms. Benedict via email, as shown in Figure 2.0.1 below. Upon receival of a deliverable, Ms. Benedict then sorts the deliverable into the students desktop folder. No further folder hierarchy or file organization is carried out past creating the student's desktop folder. This folder and file structure is trivial yet convenient for the administrator that has to continually update student data.

The flaws of this folder and file structure are revealed once a deliverable must be retrieved from a student's folder. Graduate student grading and submission inquiries are achieved by emailing Ms. Benedict directly, who then browses the files locally, and provides feedback or documents via email (Figure 2.0.1). The system requires that every deliverable is appropriately named, otherwise Ms. Benedict will have to sort these manually. Due to the number of graduate students enrolled in the C&I doctoral program, the volume of inquiries, and the subjective nature of the students' milestones, this feedback process can become quite inefficient and stressful for both parties involved.
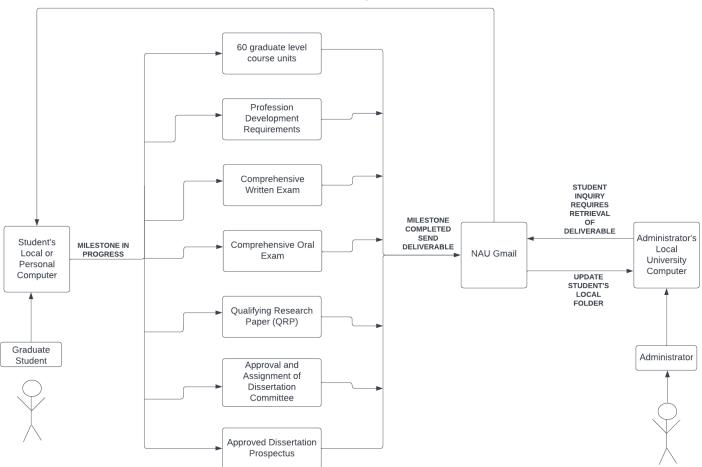
Figure 2.0.1 C&I Doctoral Program General Feedback Workflow

ADMIN REPLIES TO STUDENT INQUIRY

- 60 graduate level course units
- Profession Development Requirements
- Comprehensive Written Exam
- Comprehensive Oral Exam
- Qualifying Research Paper (QRP)
- Approval and Assignment of Dissertation Committee
- Approved Dissertation Prospectus

Student's Local or Personal Computer

MILESTONE IN PROGRESS

Graduate Student

MILESTONE COMPLETED SEND DELIVERABLE

NAU Gmail

STUDENT INQUIRY REQUIRES RETRIEVAL OF DELIVERABLE

UPDATE STUDENT'S LOCAL FOLDER

Administrator's Local University Computer

Administrator

Description: Figure 2.0.1 illustrates the bottleneck created by interfacing through NAU Gmail. As graduate students complete their milestones, they send the completed deliverables to administrators via NAU Gmail. The administrator then saves the deliverable from the email and updates the students desktop folder on a single local university computer. If an inquiry is made by a student, the administrator accesses deliverables from their appropriate student folders and completes the inquiry through email.
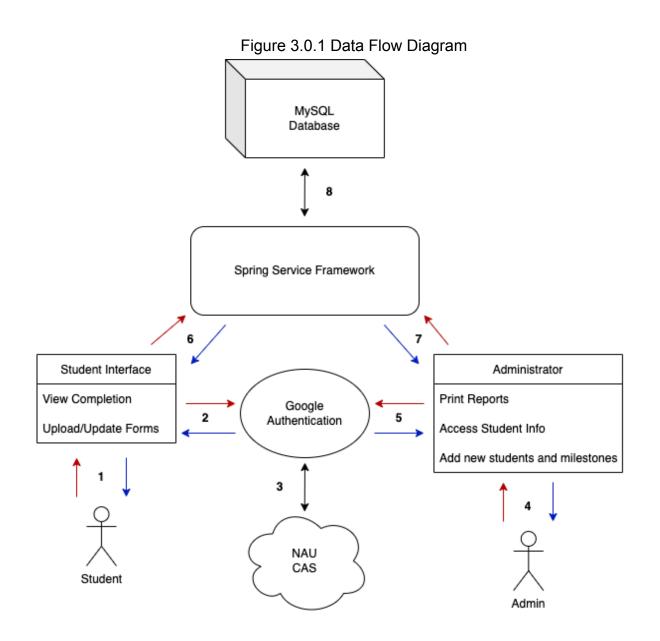
3.0 Solution Vision

As a result of the problem statement outlined above, Team What's Up Doc will create a web application that will provide graduate students with a clear way to view their progress throughout their degree. The application will be accessed through the NAU login, and displays the student's Ph.D progression status graphically. The students upload their documents and progress is updated automatically on their display. Additionally an administrator view provides ways to view and download files, as well as add new students and administrators. Data and files are stored remotely, but are accessed as the web application is used.

Key features to be provided:
- Student Interface
    - Display of completed and uncompleted milestones based on student provided files
    - Uploaded files will immediately be updated and displayed in the completion bar
    - Options to change settings (font size, colorblind settings, etc.)
- Administrator access
    - Access to individual student information and reporting statistics from population options (current, graduated, all, etc.) and downloading student files
    - Permissions options for adding new students and administrators
- General
    - User login system
    - Only NAU accounts will have access

The flow of data is shown below in figure 3.0.1 and indicates how it is moving within the system. The administrator and student data move identically throughout the system, with additional permissions granted to the former. While roles are different, they have an extremely similar flow where the student and admin access their login page (1 and 4) and are redirected to Google's servers for authentication (2 and 5) which redirects back to NAU for usage of the schools login. Once verification is complete, a request is sent from the interfaces to a server for processing (6 and 7). The server queries the database holding all the relevant student information (8) and returns it back to the user or admin for viewing (6 and 7).

Figure 3.0.1 Data Flow Diagram

4.0 Project Requirements

To be successful, the requirements of the desired product must be considered. Functional requirements are those that describe what the product is doing, and how it can be implemented. Performance requirements are measurable and testable items related to how the product completes its tasks. Environmental requirements are restrictions placed on functionality and interaction with other systems.

4.1 Functional Requirements

4.1.1 Intuitive User Interface

The user interface is the front facing view of the product and provides all of the data necessary for the user. There will be two different views for the students and administrators.

Student

The student view will consist of a graphical user interface that clearly displays their progression in their program based on the submitted milestones. This will be a style of progress bar that is colored gray before any submissions. The student will have the option to begin working on a milestone, which will fill part of the bar yellow while it is in progress. Once completed, the bar will display green for the percentage that milestone accounts for. An upload and download option will be available, discussed further in 4.1.2, but will be present on the student interface along with a display of uploaded files.

Additional setting selections will be available to modify the page to make it more accessible to a wider group of students. These settings will have an additional overlay window providing choices for things like font size, color blind, etc.

Administrator

The administrator view will have many display options for student data allowing them to view any student data available. This will include individuals, groups, currently enrolled, previous grads, or all students and all of their included milestone information. This will also be able to view all saved student milestone information, as well as additional uploads the student may provide that are not milestones but still relevant. Similar upload, download, and setting features will be present.
Additional functionality within this interface will be to provide status to users, being students or other administrators, further covered in 4.1.3

4.1.2 User Upload and Download

The ability for students to upload their milestone documentation for tracking is the core purpose of this program. Alternatively, administrators need to be able to download to keep a local backup. The stored structure will maintain the hierarchy currently used by the local storage system. Each student has their own folder with completed documents housed within.

Student

The upload function will request the file to be uploaded from the student view, provide a success or failure message, and refresh the present file view. Additional download operations will also be present in case the student misplaces or loses their documented file, as will simple removal if the incorrect or duplicate files are uploaded.

Administrator

The admin view for this will be primarily focused on the ability to download. This will have the option to download either a single student's documents, multiple students, or all as a back up. Manual loading will also be an option in the case of the student unable to upload or documentation bypasses the student. Removal is also necessary if something needs to be redone or is not considered relevant.

4.1.3 Administrative Accessibility

Accessibility for the admin view must be able to manage the database and user permissions from their page mentioned above. Managing the database is effectively adding and removing students, or adding and editing milestones. Options will include renaming students, setting relevant milestones, adding new ones, and setting permissions. Permissions are an effective status between students and administrators providing the more detailed interface to the latter. This provides a simple way of handing access off to other faculty to oversee student progress.

4.1.4 NAU Login

All NAU students are provided with login credentials to access all school related sites and resources. While accessing the school network is not a feasible option, we are able to circumvent this by way of several redirects. From both the student and admin login perspectives, they will be greeted by a "Log in with Google" button when accessing the

page. This will redirect to a standard Google page where an email address must be provided. Once an NAU email has been submitted, Google automatically redirects to NAU's Central Authentication Service (CAS) where the school's normal login occurs. Processing will occur outside of the users view, and they will be returned to their dashboard upon successful login.

4.2 Performance Requirements

Ensuring our product meets the performance requirements requires specific and testable goals. These requirements are based on the minimum viable product, additional feature requests, and the functional requirements. The following requirements are:

4.2.1 Authentication Speed

The time it takes to login to our application will likely be one of the most notable points of time lag for users. Ensuring that the time from a user submitting their credentials to being granted access to the application be as short as possible is essential. Ideally we are looking for the total time it takes to log into our application to be less than 60 seconds from entering personal credentials. We will test this by using logins for different users with varying levels of access and recording the time it takes to arrive at the landing page of the application.

4.2.2 File Upload/Download Speed

Uploading or downloading documents can take a varied amount of time depending on the length of the document and the internet connection of the user. Due to the variability of the response time, we will be testing the upload and download speeds using a file with a fixed size. In testing we want a five page pdf document to have an upload and download time of less than 30 seconds. We will test this by utilizing dummy documents of varying file size in the upload and download tests.

4.2.3 Application Readability

Ensuring the application is readable to as many users as possible is essential to ensuring its efficacy among a diverse group of potential users. In order to ensure the readability of our application, we will conduct focus group testing of our application's interface. The goal we are looking for is at least 90% of respondents' approval of our design. In order to gauge user acceptance of our application, we plan to disseminate test layouts earlier in the development process with a survey for feedback. Closer to

completion, we will test users to see if 90% of users, after a tutorial, can show competence with the application.

4.2.4 Progressive Database Response

As the database holding all the files grows, the time for an administrator to receive a report will increase. We will be testing the database's ability to produce a report based on the files inside of it. The time for the database to generate and display a report will be under 100 milliseconds. To test this, we will use dummy files to bloat the database during development in order to ensure reliable generation times.

4.3 Environmental Requirements

Dr. Gretchen McAllister imposed a number of environmental project constraints during our first meeting. The first constraint related to access: Dr. McAllister made it clear that the website application would be a College of Education (COE) website application and that it would eventually be accessible via the NAU website. This association with the NAU website entails that our website application will be a representation of the university and must be kept professional, appropriate, and relatable wherever possible. Due to the applications integration into the COE website, it also must adhere to the strict authentication and protection of privacy policy that the university administers on a daily basis. In our case, NAU students are issued an NAU gmail account upon admission that will then be used throughout their years at the university. It is imperative that NAU grad students use their linked NAU gmail account and password, protected by a two-step authentication process, to access our website application. This ensures consistency across any other COE website application they might be using at the time and guarantees that only NAU students are able to access the web app. It is then up to us developers to ensure that the correct grad students are able to access the website application when they are supposed to.

Team What's Up Doc is unable to assume any given system that a graduate student could be accessing the website application from. Therefore, we must account for all platform possibilities so that a grad student accessing the web app from their Mac sees the same content as the grad student that is accessing from their mobile phone.

The last environmental constraint our client placed on us relates to the overall usability of the website application. Dr. McAllister made it abundantly clear that her C&I graduate students are a diverse group in many different ways. This diversity is most apparent in the graduate students' age disparity and how it affects their technical abilities. Dr. McAllister argued that our website application user interface must be intuitive and

accommodating to graduate students ranging in all types of technical ability. A website application that is difficult or tedious to use will ultimately be unappealing to any user, regardless of their technical abilities, so this is a key requirement to uphold.

5.0 Potential Risks

- **Database Losing Files**
    - In the age of data, a growing worry for many people is the inevitable loss of data. Whether that be through data corruption or physical system damage, dealing with data loss is a very real risk. Losing a graduate student's submitted work is unacceptable and therefore this risk must always be accounted for.
    - There is a moderate likelihood of this occurring, as there are many ways that a computer can be damaged, or information can be scrambled.
    - To counter this possibility, we will be utilizing backups of the database, so that in the event of a loss, the backups can restore the files.
    - The severity of this risk is quite high due to the inherent academic integrity that each graduate student is adhering to. If a particular graduate student uploaded a deliverable on time but eventually became corrupted, it becomes difficult to recognize whether the student intentionally turned in unfinished work or your system resulted in corrupted data.
- **Invalid Documents**
    - There is the potential for improper documents to be uploaded by users.
    - Empty documents or the incorrect forms being uploaded to a user's progress can lead to inaccurate progress reports and future confusion if not detected early.
    - There is a small chance that a user would upload an incorrect document unintentionally, and there is little to no reason for it to be done on purpose.
    - Uploaded files will be viewable through the application, allowing for users to confirm or correct uploaded documents.
- **NAU Creating a Competing Application**
    - NAU is regularly updating both BBLearn and Louie, their primary academic tracking applications. It is possible that they either implement a third application or incorporate a similar extension into Louie or BBLearn that would accomplish a similar purpose as our application.
    - If NAU does implement a competing program, that program would become the official tracking program. In that case our program would become unnecessary.
    - As NAU has yet to implement such a program, it is not very likely that they would do so in the immediate future.
    - Should NAU create a replacement program, the files from our database could be downloaded and uploaded to the new program.

- **Unauthorized User Access**
  - Recall that this website application will be an NAU College of Education web app intended to be accessed by graduate students and administrators. Any COE related program must assume that there is student information to protect at all times. This entails a rigorous method of user authentication to ensure that the right people are accessing the right student information and the wrong people are unable to see past the login screen.
  - The likelihood of a student accidentally typing in another student's gmail information and password is slim. There is a higher likelihood of a malicious person somehow gaining access to a students gmail and password information and further infiltrating their accounts from there. We can only ensure that the correct NAU grad students are able to log into the website application, therefore, if a graduate student leaks their own gmail and password, it is up to them to recognize the breach and act accordingly through a password change.
  - The severity of this particular risk depends on our own functional requirements. If an abundance of student information can be expected to be found either in a deliverable or on the website application itself, then it is expected that this information be abstracted even further from the user. For example, if there is a dedicated student information page, then this page should have a lock on it at all times which requires third-party authentication, such as a push to DuoMobile, to unlock. Likewise, if a particular deliverable contains sensitive student information, the administrator creating the deliverable upload page can mark it as sensitive which will require a similar third-party authentication in order to view it.

6.0 Project Plan

With the previously discussed requirements and risks, planning can begin for the upcoming break and semester.

6.1 Product Development Milestones

The plan for executing this product is to initially implement the web application, database and server by having a working interface capable of requesting and displaying data allowing easy viewing of successful operations. Figure 6.1.1 below shows the current plan throughout the end of the Summer.

The first application related task is the Tech Demo. While this has been a consideration for several weeks, coding began as of 4/25. By 4/28 both the database and server had been initialized and deployed to a remote server for testing purposes. Neither of these provide all of the desired functionality, however they are proper prototypes and will suffice for a demonstration.

With the storage and communications system built and tested, work can begin on the website to act as the interface between the users and data. Initialization of this is to begin 4/30 and be completed by 5/4. This completion date is tentative as the Tech Demo has not yet been scheduled at time of writing. This would likely move forward to meet demo purposes as necessary.

The demo itself, as previously stated, has not yet been scheduled. The given time is a window of when it is expected to be completed.

While not required by the University, Summer work is planned to get ahead of schedule on some of the less familiar aspects. The chart has been adjusted to only show the first few weeks of summer (5/9 to 5/22), but tasks in these time frames are expected to be completed before the Fall semester (mid-August). Having this additional time will greatly benefit the end product in that many set up and time consuming tasks can be completed without affecting normal development windows.

The schedule will be updated accordingly at the beginning of the Fall 22 semester to accurately reflect upcoming steps and semester plans.

Figure 6.1.1 Gantt Chart

						Apr 25, 2022								May 2, 2022								May 9, 2022								May 16, 2022							

Project Start: Mon, 4/25/2022

Display Week: 1

TASK	ASSIGNED TO	PROGRESS	START	END	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
					M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S
Tech Demo																																
Initialization	All	66%	4/25/22	5/6/22																												
Database	Adam	100%	4/25/22	4/28/22																												
Server	Adam	100%	4/25/22	4/28/22																												
Web App	Brandon/Eddie	0%	4/30/22	5/4/22																												
Demo	All		5/4/22	5/6/22																												
Summer Tasks																																
Authentication Set Up	Adam	0%	5/9/22	8/20/22																												
AWS Research/Set Up	Adam	0%	5/9/22	8/20/22																												
Deploy DB to AWS	Adam	0%	5/9/22	8/20/22																												
Modify Server for AWS	Adam	0%	5/9/22	8/20/22																												
Admin load script	Adam	40%	5/9/22	8/20/22																												

7.0 Conclusion

Learning from one's mistakes is an invaluable part of the education process, however it must be facilitated through a feedback process. Due to the rigor associated with the Curriculum and Instruction doctoral program, using a standard LMS, such as Blackboard Learn, is not feasible to manage the program. Therefore, the current feedback process utilizes NAU Gmail for all milestone inquiries. Curriculum & Instruction graduate students submit deliverables and receive feedback via email, creating an unfortunate time bottleneck. Team What's Up Doc aims to reimplement a College of Education website application to provide feedback to graduate students enrolled in the NAU C&I doctoral program by allowing instant access to their milestone progress and by providing automated ways to submit deliverables. A working website application would circumvent having to interface through the NAU Gmail, freeing up valuable time for both graduate students and administrators. Our web app would also relinquish Dr. Gretchen McAllister, Coordinator, and Michele Benedict, Administrative Services Assistant, from their data entry duties. In this Requirements Specification document, Team What's Up Doc identified the functional, nonfunctional, and environmental requirements needed in order to deliver a successful website application and provide the team and client a record of what will be considered a 'finished product'. With this Requirements Specification agreement in mind, Team What's Up Doc will be able to move forward in the development of the tech demo and are closer to reaching our scheduled tech demo showing during the first week of May 2022.

8.0 References

[1] Hanson, Melanie. "College Enrollment Statistics [2022]: Total + by Demographic." *Education Data Initiative*. 22 Jan. 2022. <https://educationdata.org/college-enrollment-statistics#:~:text=Report%20Highlights.,students%20are%20in%20graduate%20programs.>.